



Tennessee Valley Authority, Post Office Box 2000, Decatur, Alabama 35609-2000

August 9, 2010

ATTN: Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, D. C. 20555-0001

10 CFR 50.73

Subject: Licensee Event Report 50-260/2010-003-00

The enclosed Licensee Event Report (LER) provides details of a valid reactor scram due to closure of the Main Steam Isolation Valves (MSIV) and a subsequent invalid actuation of the Reactor Protection System (RPS) from the Intermediate Range Monitoring (IRM) system that occurred following completion of the safety functions.

The initial verbal notification of the invalid RPS actuation from the IRMs stated that it was reportable per 10 CFR 50.72(b)(3)(iv)(A) and required an LER within 60 days per 10 CFR 50.73(a)(2)(iv)(A). However, the Tennessee Valley Authority (TVA) has since determined that this event is not reportable per 10 CFR 50.72(b)(3)(iv)(A) or 10 CFR 50.73(a)(2)(iv)(A) since the actuation was from an invalid signal and occurred after the safety function had already been completed. Discussion of the IRM related RPS actuation in the enclosed LER is for completeness of the event description.

The TVA is submitting this report in accordance with 10 CFR 50.73 (a)(2)(iv)(A) as any event or condition that resulted in manual or automatic actuation of any of the systems listed in paragraph 10 CFR 50.73(a)(2)(iv)(B)(1) and (2), i.e., the Reactor Protection System, including reactor scram or reactor trip, and general containment isolation signals affecting more than one system.

There are no commitments contained in this letter. Should you have any questions concerning this submittal, please contact D. W. Williamson acting Site Licensing and Industry Affairs Manager at (256) 729-2636.

Respectfully



K. J. Polson
Vice President

cc: See page 2

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MRR

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Enclosure

cc (w/ Enclosure):

NRC Regional Administrator - Region II

NRC Senior Resident Inspector - Browns Ferry Nuclear Plant

NRC FORM 366 (9-2007)		U.S. NUCLEAR REGULATORY COMMISSION		APPROVED BY OMB NO. 3150-0104		EXPIRES 08/31/2010	
LICENSEE EVENT REPORT (LER)							
1. FACILITY NAME Browns Ferry Unit 2				2. DOCKET NUMBER 05000260		3. PAGE 1 of 5	
4. TITLE: Reactor Scram Due to Closure of the Main Steam Isolation Valves and Subsequent Invalid RPS Scram From The Intermediate Range Monitoring System							
5. EVENT DATE			6. LER NUMBER			7. REPORT DATE	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REV NO.	MONTH	DAY
06	09	2010	2010	- 003	- 00	08	09
						8. OTHER FACILITIES INVOLVED	
						FACILITY NAME None	
						DOCKET NUMBER N/A	
						FACILITY NAME None	
						DOCKET NUMBER N/A	
9. OPERATING MODE 1		11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: <i>(Check all that apply)</i>					
10. POWER LEVEL 100		<input type="checkbox"/> 20.2201(b) <input type="checkbox"/> 20.2203(a)(3)(i) <input type="checkbox"/> 50.73(a)(2)(i)(C) <input type="checkbox"/> 50.73(a)(2)(vii)					
		<input type="checkbox"/> 20.2201(d) <input type="checkbox"/> 20.2203(a)(3)(ii) <input type="checkbox"/> 50.73(a)(2)(ii)(A) <input type="checkbox"/> 50.73(a)(2)(viii)(A)					
		<input type="checkbox"/> 20.2203(a)(1) <input type="checkbox"/> 20.2203(a)(4) <input type="checkbox"/> 50.73(a)(2)(ii)(B) <input type="checkbox"/> 50.73(a)(2)(viii)(B)					
		<input type="checkbox"/> 20.2203(a)(2)(i) <input type="checkbox"/> 50.36(c)(1)(i)(A) <input type="checkbox"/> 50.73(a)(2)(iii) <input type="checkbox"/> 50.73(a)(2)(ix)(A)					
		<input type="checkbox"/> 20.2203(a)(2)(ii) <input type="checkbox"/> 50.36(c)(1)(ii)(A) <input checked="" type="checkbox"/> 50.73(a)(2)(iv)(A) <input type="checkbox"/> 50.73(a)(2)(x)					
		<input type="checkbox"/> 20.2203(a)(2)(iii) <input type="checkbox"/> 50.36(c)(2) <input type="checkbox"/> 50.73(a)(2)(v)(A) <input type="checkbox"/> 73.71(a)(4)					
		<input type="checkbox"/> 20.2203(a)(2)(iv) <input type="checkbox"/> 50.46(a)(3)(ii) <input type="checkbox"/> 50.73(a)(2)(v)(B) <input type="checkbox"/> 73.71(a)(5)					
		<input type="checkbox"/> 20.2203(a)(2)(v) <input type="checkbox"/> 50.73(a)(2)(i)(A) <input type="checkbox"/> 50.73(a)(2)(v)(C) <input type="checkbox"/> OTHER					
						Specify in Abstract below or in NRC Form 366A	
12. LICENSEE CONTACT FOR THIS LER							
NAME Steve Austin, Licensing Engineer						TELEPHONE NUMBER (Include Area Code) 256-729-2070	
13. COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT							
CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX		CAUSE	SYSTEM
14. SUPPLEMENTAL REPORT EXPECTED <input type="checkbox"/> YES (If yes, complete 15. EXPECTED SUBMISSION DATE) <input checked="" type="checkbox"/> NO						15. EXPECTED SUBMISSION DATE	
						MONTH	DAY
						N/A	N/A
						YEAR	
						N/A	N/A
ABSTRACT <i>(Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines)</i>							
<p>On June 9, 2010, at approximately 0330 hours Central Daylight Time (CDT), outboard Main Steam Isolation Valve (MSIV) A closed while transferring the Reactor Protection System (RPS) 120 V-AC power from the normal to the alternate power supply in preparation for a planned activity. At approximately 0331 hours CDT Unit 2 received a Primary Containment Isolation Signal (PCIS) Group 1 isolation signal resulting in the closure of all of the MSIVs and automatic reactor scram. During the scram, all automatic functions occurred as expected. All control rods inserted. Operations personnel briefly entered Emergency Operating Instruction, 2-EOI-001, "Reactor Pressure Vessel Control," controlling both reactor vessel pressure and reactor vessel water level. At approximately 0335 hours CDT, Operations personnel reset the PCIS Group 1 Isolation Signal, and by approximately 0341 hours the reactor scram was reset. The root cause for the MSIV closure event is indeterminate. TVA's analysis identified two possible causes: 1) Debris from the control air system in the Direct Current (DC) solenoid plunger area or, 2) DC power system electrical circuitry issues. TVA plans to install a filter in the control air system upstream of the of the outboard MSIV control air header. TVA also plans to install transient monitoring equipment on the DC solenoid circuit and evaluate the results. If the results of the monitoring change the root cause and corrective actions, TVA will provide a revised report.</p>							

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FACILITY NAME (1)	DOCKET (2)	LER NUMBER (6)			PAGE (3)
Browns Ferry Nuclear Plant Unit 2	05000260	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	2 of 5
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NARRATIVE

I. PLANT CONDITION(S)

Prior to the events, Browns Ferry Nuclear Plant (BFN) Units 1, 2, and 3 were operating in Mode 1 at 100 percent thermal power (approximately 3458 megawatts thermal). The Unit 2 Reactor Protection Systems (RPS) [JC] A and B were being provided electrical power from their normal supply.

II. DESCRIPTION OF EVENT

A. Event:

On June 9, 2010, at approximately 0330 hours Central Daylight Time (CDT), outboard Main Steam Isolation Valve (MSIV) A [SB] closed while transferring the Reactor Protection System (RPS) 120 V-AC power from the normal to the alternate power supply in preparation for a planned activity. At approximately 0331 hours CDT Unit 2 received a Primary Containment Isolation Signal (PCIS) Group 1 [JE] isolation signal resulting in the closure of all of the MSIVs and automatic reactor scram.

During and following the performance of the RPS power transfer several actions took place rapidly leading to the automatic reactor scram. The sequence leading to the scram, shown below, was obtained from the Unit 2 event recorder starting at approximately 0330 hours CDT.

- 6.7 seconds: The power to RPS B lost power during the manual transfer and subsequent expected half scram.
- 8.0 Seconds: The steam flow began to drop in Main Steam Line (MSL) A as the outboard MSIV A closes. The steam flow in MSLs B, C and D began to rise.
- 10.0 Seconds: The steam flow in MSL A is less than 2 million pounds per hour (Mlb/hr). The flow in MSLs B, C, and D increased to greater than 4 Mlb/hr.
- 10.3 Seconds: Unit 2 receives a PCIS Group 1 initiation signal on high steam flow. All of the MSIVs go closed.
- 10.5 seconds: Unit 2 auto scram contactor A indicates alarm. The Auto scram contactor B is already tripped due to the signal from the B RPS lost power during power transfer. This leads to the full reactor scram.

During the MSIV scram, all automatic functions occurred as expected. All control rods [AA] inserted. Operations personnel briefly entered Emergency Operating Instruction, 2-EOI-001, "Reactor Pressure Vessel Control," controlling both reactor vessel pressure and reactor vessel water level.

The Group 1 PCIS initiation signal was the only isolation signal that was received prior to the reactor scram. The A Control Room Emergency Ventilation (CREV) [VI] system auto initiated. Standby Gas Treatment (SGT) [BH] subsystems A, B, and C were in service prior to the event and continued to operate through the event. Operations personnel manually initiated High Pressure Coolant Injection (HPCI) [BJ] and Reactor Core Isolation Cooling [BN] (RCIC) systems to control reactor water level. Reactor pressure vessel pressure was controlled by manually opening one safety relief valve and the MSL drain valves.

At approximately 0335 hours CDT, Operations personnel reset the PCIS Group 1 Isolation Signal, and by approximately 0341 hours the reactor scram was reset. By 0405 hours CDT the MSIVs were reopened, Operations personnel then controlled the reactor pressure with the turbine bypass valves [JI]. A heat rejection path was established using the main condenser

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[KE]. HPCI and RCIC were removed from service and the reactor water level was being maintained with the condensate [SG] and feedwater [SJ] systems.

At 0408 hours CDT, with the reactor in Mode 3, BFN received a second RPS actuation which was invalid. Intermediate Range Monitor (IRM) [IG] F experienced a momentary signal increase with concurrent spikes on the IRM C. All systems responded as designed. All required safety functions were previously completed; therefore, no safety system actuations occurred. The invalid RPS actuation and reactor scram was reset at 0431 hours CDT.

TVA is submitting this report in accordance with 10 CFR 50.73(a)(2)(iv)(A). An event that resulted in a manual or automatic actuation of the systems listed in paragraph 10 CFR 50.73(a)(2)(iv)(B) (i.e., reactor protection system including reactor scram or trip, and general containment isolation signals affecting containment isolation valves in more than one system or multiple main steam isolation valves (MSIVs)).

B. Inoperable Structures, Components, or Systems that Contributed to the Event:

None

C. Dates and Approximate Times of Major Occurrences:

June 9, 2010, 0330 hours CDT	Unit 2 receives a PCIS Group 1 initiation signal
June 9, 2010, 0331 hours CDT	Unit 2 automatically scrammed on closure of the MSIVs.
June 9, 2010, 0341 hours CDT	Operations reset the MSIV scram.
June 9, 2010, 0408 hours CDT	Unit 2 receives an invalid RPS actuation and automatic reactor scram on when IRMs F and C concurrently spiked.
June 9, 2010, 0431 hours CDT	Operations reset the invalid RPS actuation and scram.
June 9, 2010, 0658 hours CDT	TVA made a four hour non-emergency report per 10 CFR 50.72(b)(2)(iv)(B) and an eight hour non-emergency report per 10 CFR 50.72(b)(3)(iv)(A).

D. Other Systems or Secondary Functions Affected

None

E. Method of Discovery

The automatic reactor scram from the MSIV closure was immediately apparent to Operations personnel through numerous alarms and indications in the main control room.

F. Operator Actions

Operations personnel responded to the reactor scram and MSIV closure according to Abnormal Operating Instruction, AOI-100-1, "Reactor Scram," as required. Operations momentarily entered Emergency Operating Instruction, EOI-1, "Reactor Pressure Control."

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G. Safety System Responses

Following the Group 1 RPS scram, all control rods inserted, CREV A auto started and SGT A, B, and C were in service prior to the scram and continued to operate through the event. No Emergency Core Cooling System setpoints were reached during the MSIV scram.

III. CAUSE OF THE EVENT**A. Immediate Cause**

The immediate cause of the automatic scram was the closure of MSIV A which resulted in MSL high flow and PCIS Group 1 isolation and subsequent closure of all of the remaining MSIVs resulting in completing the actuation of the RPS.

B. Root Cause

The root cause for the MSIV A closure was indeterminate. TVA's analysis identified two possible causes: 1) Debris from the control air system in the Direct Current (DC) solenoid plunger area or 2) DC power system [E] electrical circuitry issues. TVA's post scram testing and evaluation did not find any evidence of a failure due to debris. However, Units 1 and 3 have a filter installed on the control air supply to the MSIVs. Unit 2 does not.

There is currently insufficient data to establish whether the DC power system may have played a role in the event.

C. Contributing Factors

None

IV. ANALYSIS OF THE EVENT

TVA's evaluation of the event indicates that MSIV A closed during the RPS power transfer resulting in an unanticipated PCIS Group 1 isolation and full reactor scram. As the MSIV closed, the reactor pressure and steam flow through the remaining steam lines increased until the PCIS Group 1 isolation setpoint was reached and all of the MSIVs closed. The Reactor automatically scrammed, as designed on MSIV closure.

The loss of RPS power was a planned evolution controlled by an existing plant procedure. By procedure the power to the 120-V AC was lost to RPS B during the power transfer and resulted in a half scram on Unit 2. Plant control air [LD] is used as a motive force for the outboard MSIVs. Regardless of the status of the AC power, the MSIV air control is designed to keep the MSIV open with the DC powered solenoid and the subsequent full reactor scram should have not occurred. The procedure in use during the event requires a verification of the DC solenoid integrity by measuring voltage drop through the circuit. This verification was performed satisfactorily. However, during RPS power transfer, the DC solenoid failed to maintain the air supply to the A MSIV and as a result it closed.

With the exception of the DC-powered solenoid, all plant equipment and logic performed as expected during the event.

V. ASSESSMENT OF SAFETY CONSEQUENCES

The safety consequences of the reactor scram from the MSIV closure was not significant. A reactor scram from 100 percent power is analyzed by the BFN Updated Final Safety Analysis Report. The MSIV closure scram is bounded by a generator load reject without bypass valves.

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Following the reactor scram all engineered safety features functioned as designed. All control rods fully inserted. The reactor water level was controlled by the Operator using both HPCI and RCIC in the manual mode. The peak reactor pressure during the event reached 1052 psig therefore no relief valve setpoints were challenged. Once the MSIVs were reopened, the feedwater and condensate system were used for reactor vessel water level control. The reactor pressure vessel pressure was controlled with the turbine bypass valves. A heat rejection path was established using the main condenser. Therefore, TVA concludes that the event did not affect the health and safety of the public.

VI. CORRECTIVE ACTIONS

A. Immediate Corrective Actions

The MSIV solenoid manifold which includes the three solenoids, AC solenoid, DC solenoid and a test solenoid, was replaced. The manifold that was in place during the event was sent to an offsite site facility for diagnostic evaluation.

To validate the performance of the replacement manifold, the MSIV was successfully fast stroked. RPS B was transferred back to the normal power to validate the AC, DC, and test solenoid coils functioned properly.

B. Corrective Actions to Prevent Recurrence - (The corrective actions to prevent recurrence are being managed by TVA's Corrective Action Program.)

TVA plans to install a filter in the control air system upstream of the of the outboard MSIV control air header similar to Units 1 and 3. TVA also plans to install transient monitoring equipment on the DC solenoid circuit and evaluate the results. If the results of the monitoring change the root cause and corrective actions, TVA will provide a revised report.

VII. ADDITIONAL INFORMATION

A. Failed Components

None

B. Previous LERs on Similar Events

None

C. Additional Information

Corrective action documents for this report are Problem Evaluation Reports 233981 and 234151.

D. Safety System Functional Failure Consideration:

This event is not a safety system functional failure in accordance with NEI 99-02.

E. Scram With Complications:

This event was not a complicated scram according to NEI 99-02.

VIII. COMMITMENTS

None